



WINCOMM UAT Laboratory Test Results and Flight Test Plans

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APL

The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Motivation

- 1997 Presidential call for reduction in fatal aircraft accidents



Glenn Research Center



Aviation Safety and Security Program



Weather Information Communications

Transmit weather information from:

Aircraft → Ground

Aircraft → Aircraft

Ground → Aircraft



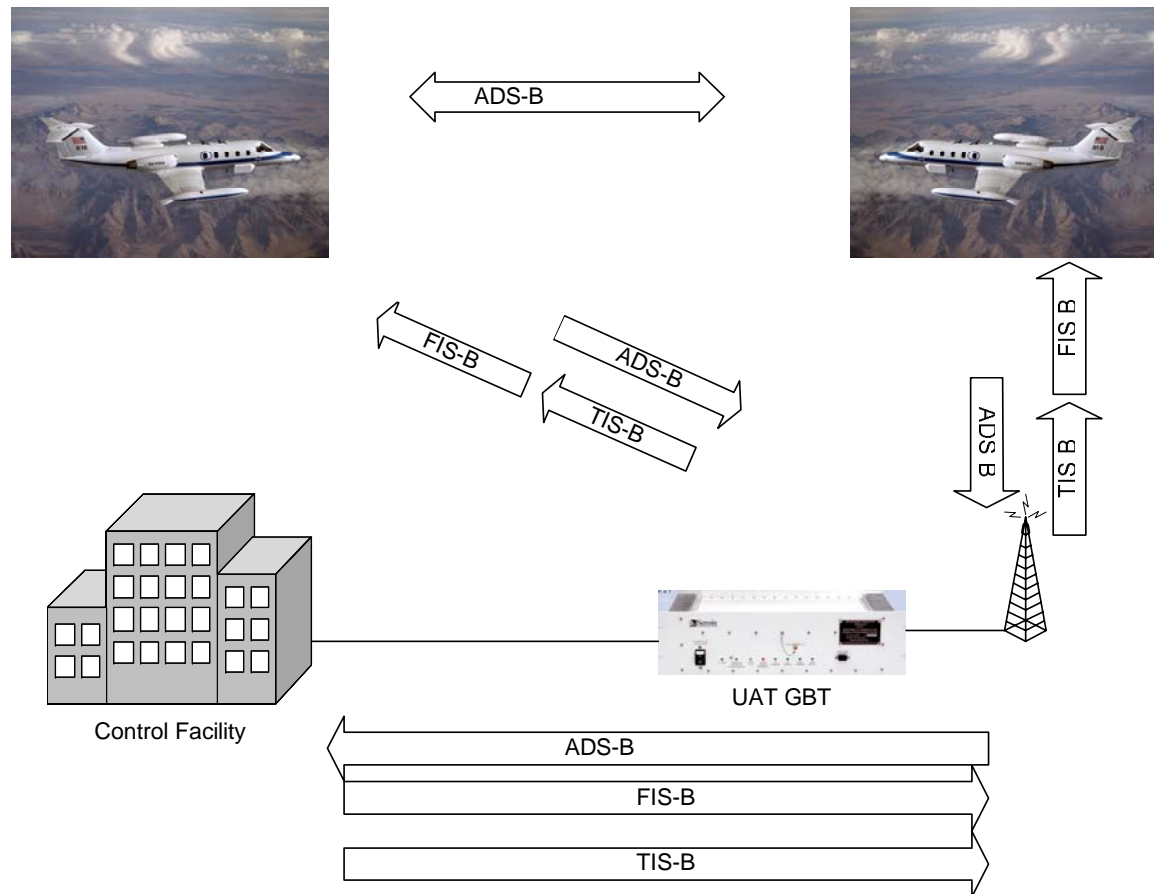
Tropospheric Airborne
Meteorological Data Reporting
(TAMDAR)

AIRMET, SIGMET, Convective
SIGMET, TFR, Graphical TFR



For more information visit
<http://wxap.grc.nasa.gov/wincomm/>

TAMDAR System Overview



Laboratory Test – FAATC Atlantic City, NJ

Test Objectives:

1. New Functionality - system validation of data transfer functionality
2. Legacy Conflicts - verify modifications to airborne and ground equipment did not adversely impact the operation of existing equipment.

<u>Air to/from Ground</u>	TAMDAR Data Transfer	New FIS-B Products
Unmodified Avionics – Unmodified GBT		
Modified Avionics – Unmodified GBT	Verify reception of TAMDAR data by unmodified GBT does not affect normal operation	
Unmodified Avionics – Modified GBT		Verify new FIS products do not adversely affect unmodified avionics
Modified Avionics – Modified GBT	Verify proper reception of TAMDAR data by modified GBT	Verify new FIS products are received and displayed properly

Laboratory Test – FAATC Atlantic City, NJ

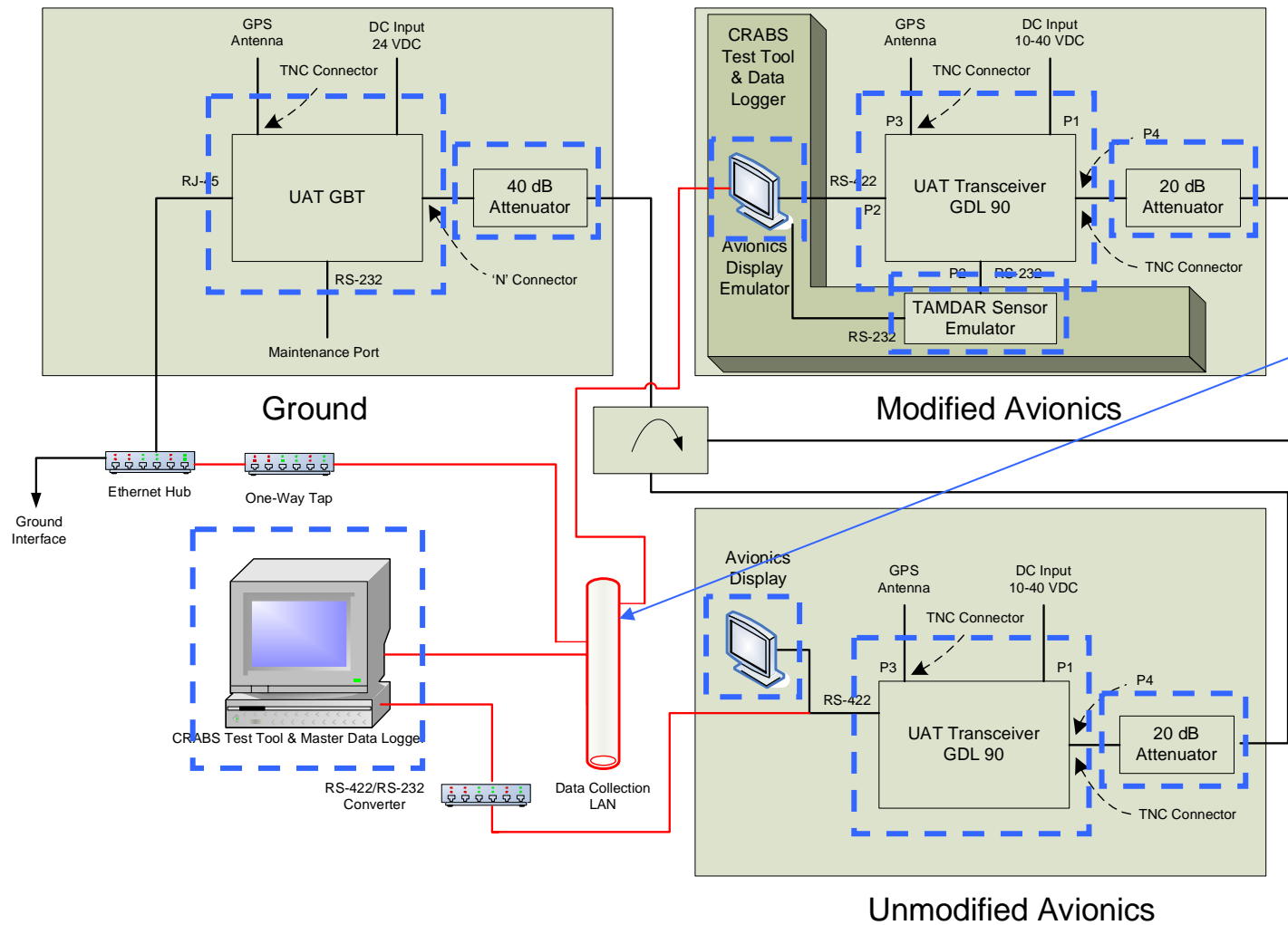
Test Objectives:

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<u>Air to Air</u>	TAMDAR Data Transfer
Unmodified Avionics – Unmodified Avionics	
Unmodified Avionics – Modified Avionics	Verify reception of TAMDAR data by unmodified avionics does not affect normal operation
Modified Avionics – Modified Avionics	Verify proper transmission and reception of TAMDAR data

Laboratory Test Setup

TAMDAR Emulation



Avionics Display Emulator (ADE)

Software: Comprehensive
Real-time Analysis of
Broadcast Systems (CRABS)

Serial interface with UAT:

UAT → ADE

Uplink and Traffic Reports

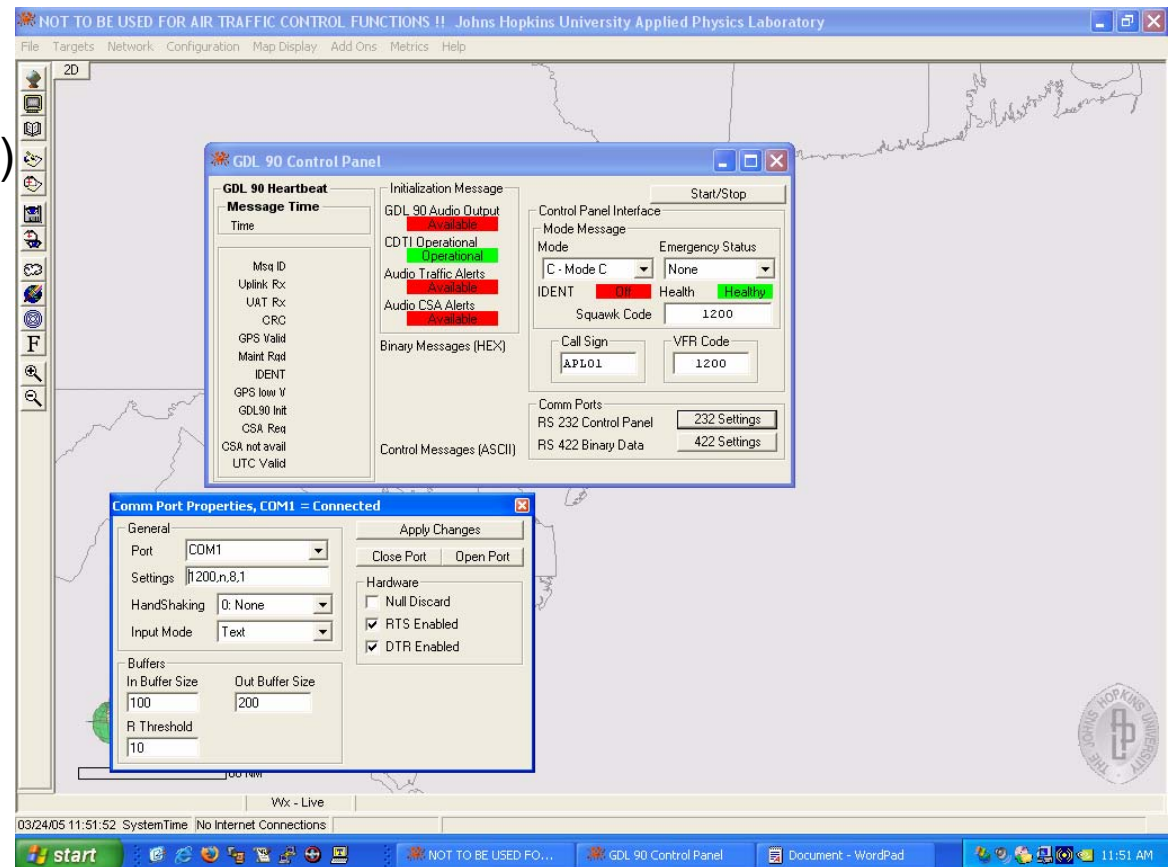
ADE → UAT

User Settings

Data Logging:

Records/Playback raw binary
data stream

Extracts messages
(ASTERIX,UAT) into comma
delimited files



New FIS-B Product Uplink

- **Textual:**
 - AIRMET – moderate weather notifications
 - SIGMET – severe weather notifications
 - Convective SIGMET

The screenshot displays the 'FIS Products' application window. On the left, a tree view shows the hierarchy: FIS Products (1) > APDU Products (2) > FIS Text Products (5) > Convective SIGMET (4). The selected product is '33C'. The main pane shows 'FIS-B Product: Generic Text (1)' with the value '33C'. Below this, several metadata sections are visible:

External Data Source Info	
Expected Data Type	FIS-B with UAT Header
Geographic Location	Any GeoLoc
Physical Layer	Serial
Port	6
Local Milliseconds	38970955
Local MicroSeconds this MS	973
Requires PreProcessing	False
PreProcessing Description	GDL 90 Async HDLC
UAP	0

APDU Header	
APDU ID	-2
Seg Flag	False

Segmentation Block	
APDU #	0
Prod Len	0

Product Description	
Product ID	413
Has Prvdr	False
Has Geo	False
Has Mthd	False

App Methods	
Comprsn	0
Geo Ref	0

Geo Locator	
Extent	0
Lat	0
Lon	0

Time	
Has Dav	False
Has Secs	False
Time	15:48:00

Location ID: 33C
 UTC Time: 17 - 1548Z
 Type: Convective SIGMET (1)
 Subset:

Message Payload
 VALID UNTIL 1755Z
 TX
 20ESE IAH
 ISOL EMBD SEV TS D20 MOV FROM 19025KT. TOPS TO FL400.
 TORNADOES...HAIL TO 1 IN...WIND GUSTS TO 50KT POSS.

Raw Message
 WST 33C 171548Z VALID UNTIL 1755Z
 TX
 20ESE IAH
 ISOL EMBD SEV TS D20 MOV FROM 19025KT. TOPS TO FL400.
 TORNADOES...HAIL TO 1 IN...WIND GUSTS TO 50KT POSS.

Air to Air TAMDAR Transfer

Data from APL01 Modified Avionics

Example depicts UAT traffic report associated with APL02 modified avionics

Raw Message Display

UAT Airborne Msg Display - Msg Valid

Header

Payload Type 2
Address Qualifier 0
Address 2

State Vector

Latitude 39.44568
Longitude -74.56374
Altitude Type 1
Altitude -75
Nav Integrity 9
Air-Ground State Ground
UTC Coupled True
Tis-B Site 0

Auxiliary State Vector

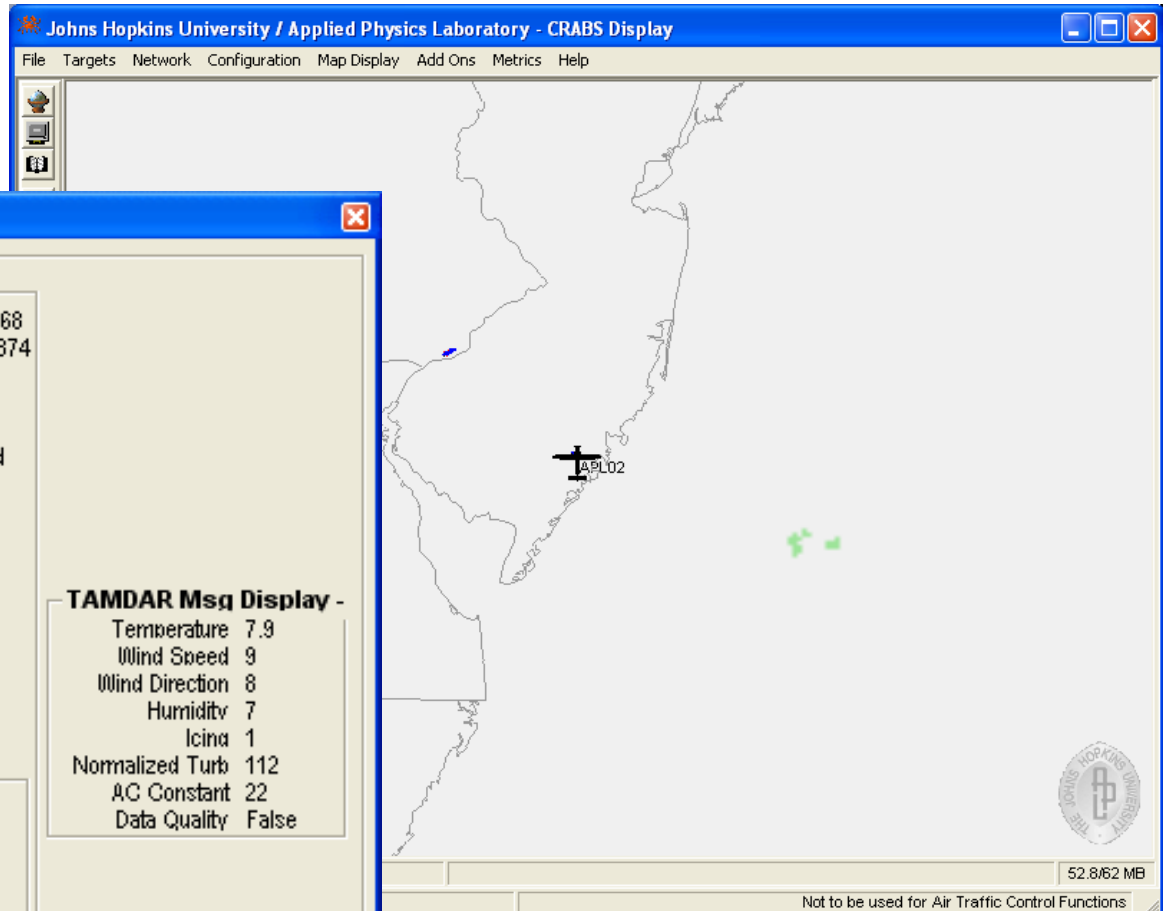
Secondary Alt -1

On Ground

Ground Speed 1
Trk Ang/Head Fmt 0
Trk Ang/Head 0
A/W Len & Width 0
POA False

TAMDAR Msg Display -

Temperature 7.9
Wind Speed 9
Wind Direction 8
Humidity 7
Icing 1
Normalized Turb 112
AC Constant 22
Data Quality False



Air to Ground TAMDAR Transfer

Data from Modified GBT:

Example depicts ADS-B report associated with APL02 Modified Avionics

ASTERIX 33 Message Display - CRC Test Pass

ASTERIX 33 Message Display		Local Time		TAMDAR Msg Display -	
Version Number	Aircraft Address	Time 06:01:29		Temperature 41.9	
Spare Bit 1	Spare 0	Time of Applicability		Wind Speed 11	
Spare Bit 2	Qualifier 0	Time 11:01:31		Wind Direction 47	
Status 0	Address 2	Position	Pressure Altitude	Humidity 44	
Number 1		Lat 39.44566011	Resolution 0	Ice 1	
		Lon -74.56371546	Spare 0	Normalized Turb 148	
			Altitude ---	AC Constant 109	
GPS Integrity and Acc		Source ID	Geometric Altitude	Data Quality False	
UTC True		SAC 2	Height -50		
NIC 10		SIC 1			
SIL ---					
NAC ---					
Pos Est? False					
Vel Est False					
Spare 0					
Link Technology Indicator	Surface Velocity				
Spare Bit False	Trk/Hd Valid False				
Link Version 0	Trk/Hdg 0				
1090 ES False	True/Mag 0				
UAT True	Heading 0				
VDL4 False	Speed 1				
Other False					
		Time of Msg Rx			
		Time 0.759749799			

Laboratory Results Summary

✓ All **Air Ground** test functions were verified

<u>Air to/from Ground</u>	TAMDAR Data Transfer	FIS-B
Unmodified Avionics – Unmodified GBT		
Modified Avionics – Unmodified GBT	✓ Verify reception of TAMDAR data by unmodified GBT does not affect normal operation	
Unmodified Avionics – Modified GBT		✓ Verify new FIS products do not adversely affect unmodified avionics
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Laboratory Results Summary

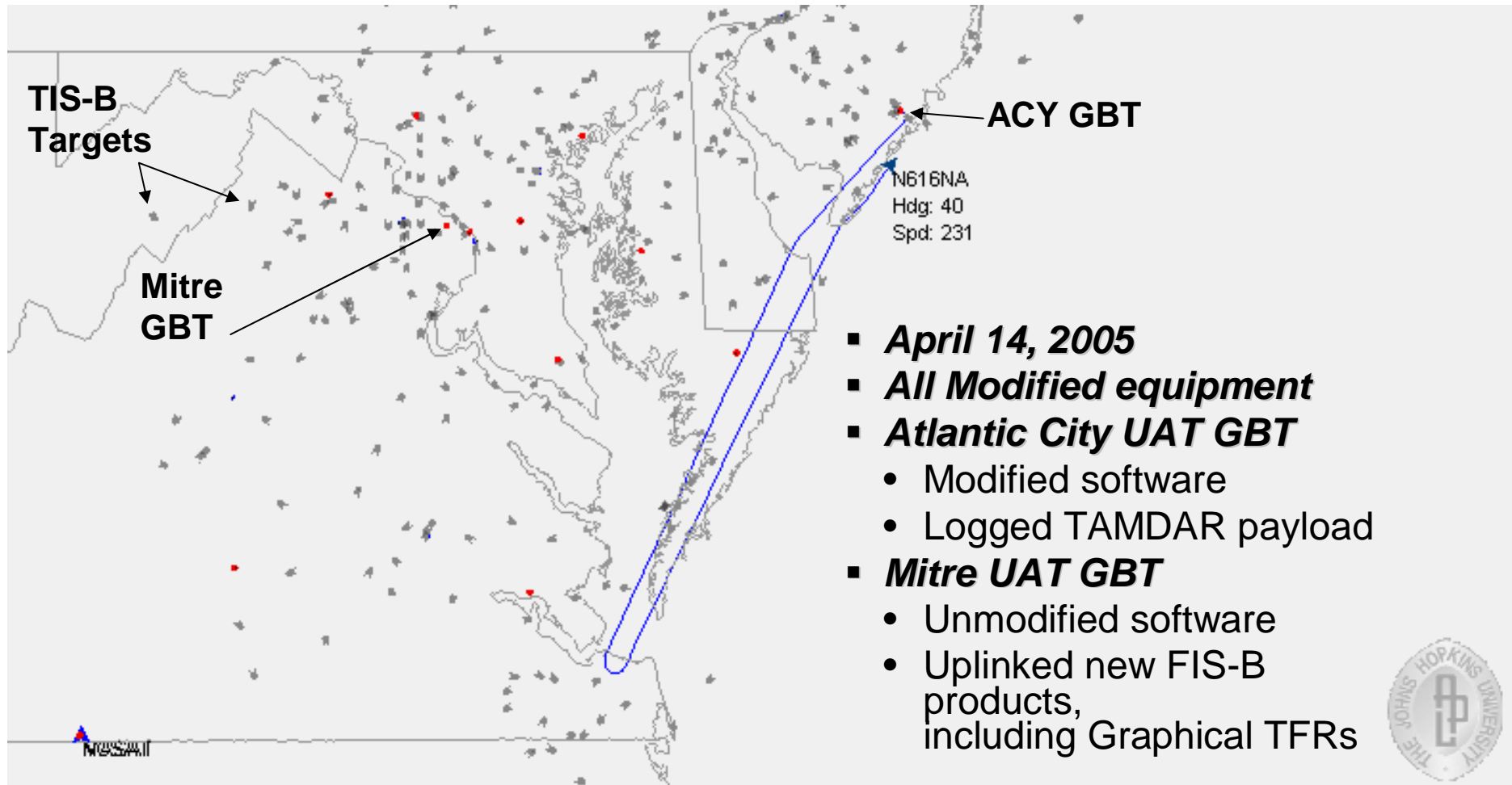
✓ All **Air to Air** test functions were verified

<u>Air to Air</u>	TAMDAR Data Transfer
Unmodified Avionics – Unmodified Avionics	
Unmodified Avionics – Modified Avionics	✓Verify reception of TAMDAR data by unmodified avionics does not affect normal operation
Modified Avionics – Modified Avionics	✓Verify proper transmission and reception of TAMDAR data

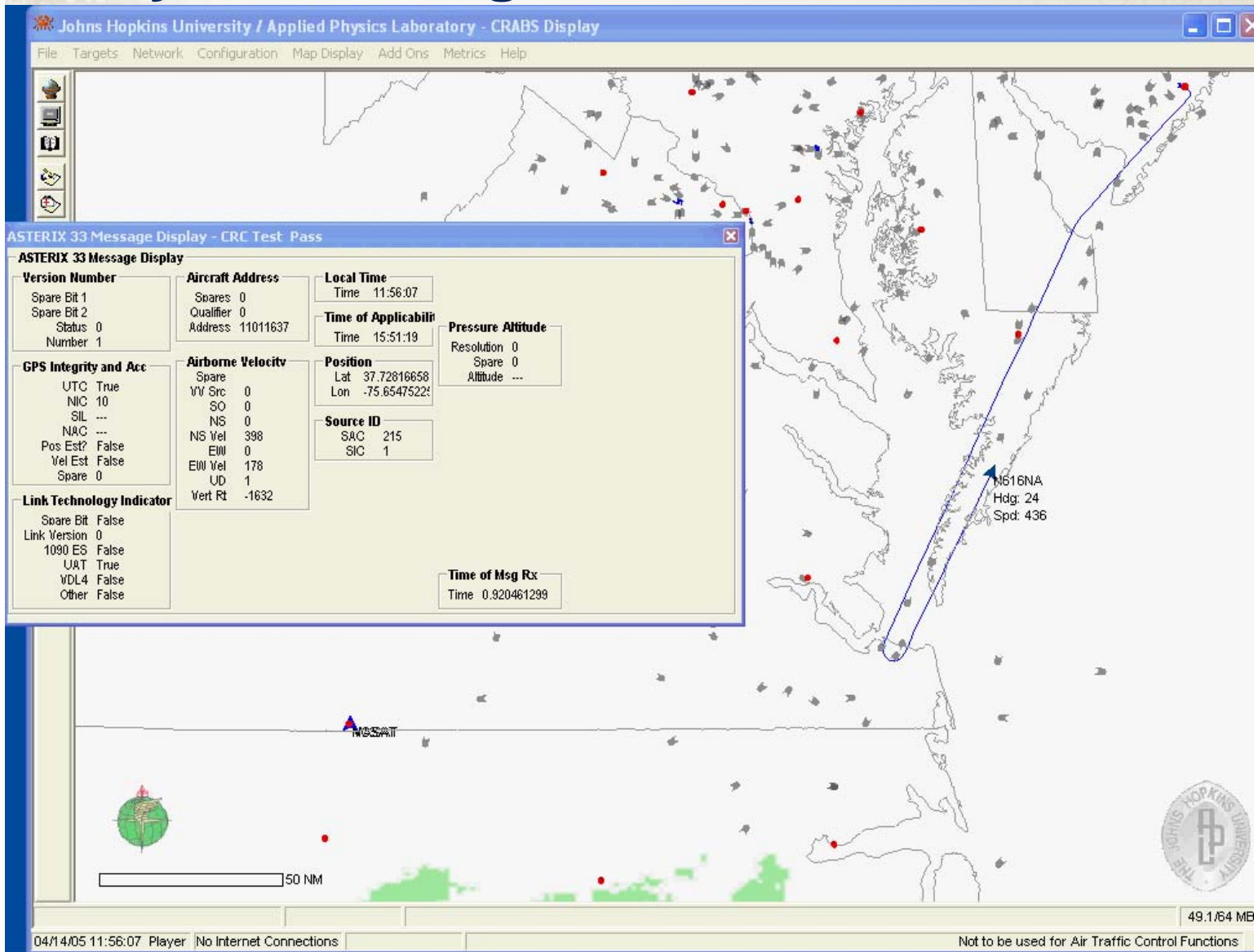
Flight Check

Test Functions

- Verify TAMDAR receipt at ACY GBT
- Verify new FIS-B product receipt at Avionics



Playback of Flight Check



Playback data includes:

- Live East Coast Network feed
- ADS-B reports from Modified ACY GBT